

Anterior rerouting of the 1,2 intercompartmental supraretinacular artery-based bone graft for scaphoid non-union: an anatomical study

Dear Editor,

Several surgical techniques have been described to treat scaphoid non-union with bone grafts depending on its location, the vascularity of the proximal pole, the volume of bone loss, and the severity of carpal collapse. Zaidenberg et al. (1991) described a dorsally-based radial bone graft vascularized by the 1,2 intercompartmental supraretinacular artery (1,2 ICSRA). This graft is mainly indicated for avascular necrosis of the proximal pole of the scaphoid without major bone loss or carpal collapse. The dorsal position of the 1,2 ICSRA over the extensor compartments and the required dorsal wrist approach give access to the proximal pole of the scaphoid with ease while more distal sites of non-union are difficult to reach (Henry, 2018).

Previous studies affirmed that volar placement of the graft to treat more distal non-unions is possible in certain circumstances (Henry, 2018; Saint Cast et al., 2012; Waitayawinyu et al., 2008; Zaidenberg et al., 1991). In an anatomical study, we describe a technical modification of the 1,2 ICSRA vascularized bone graft with anterior rerouting for treatment of scaphoid nonunions. Following red dye injection, 11 fresh cadaveric forearms from four women and two men with a mean age of 81 years (range 66–95) were dissected.

The surgical approach was dorso-radial sinusoidal. The skin, subcutaneous tissues, and sensory branches of the radial nerve were dissected to expose the extensor retinaculum above which the 1,2 ICSRA artery is located between the first and second extensor compartments. An 8 × 10 mm cortico-cancellous graft was harvested. The first and second extensor compartments were incised, and

the pedicle was elevated from the radius with its periosteum. The approach was then extended towards the palm to access the scaphoid after opening the radio-scapho-capitate ligament. A middle or distal third fracture of the scaphoid was then simulated.

The length of the pedicle, corresponding to the distance between the tip of the styloid and the proximal end of the graft harvest site, was measured. The distance between the tip of the radial styloid process and the grafting site in the scaphoid was measured following the path of the pedicle below the tendons of the first compartment. The total grafting distance was measured between the proximal end of the harvesting site and the anterior grafting site in the scaphoid. The rotation arc of the graft corresponding to the dihedral angle between the harvest site and the anterior graft site in the scaphoid was calculated using the tip of the radial styloid as the intersection point. This arc was measured with a goniometer. The graft was then rerouted under the tendons of the first compartment and inserted into the artificially created non-union site (Figure 1). Length measurements were done with a textile thread fixed to the radial styloid and to the grafting and harvesting sites. These distances were then measured on the thread with a millimetric ruler.

The 1,2 ICSRA was always present over the extensor retinaculum between the first and second compartments. The mean distance between the proximal end of the graft and the tip of the radial styloid was 29 mm (SD 4) (range 22–37). The distance between the radial styloid and the anterior grafting site in the scaphoid was 24 mm (SD 5) (range 15–31). The total distance between the proximal edge of the graft collection area and the grafting site was 52 mm (SD 8) (range 37–64). The angle of rotation required to move the graft from the scaphoid to the anterior aspect of the scaphoid was 122° (SD 20°) (range 90°–155°).

All pedicled grafts could be diverted under the tendons of the first compartment and were placed

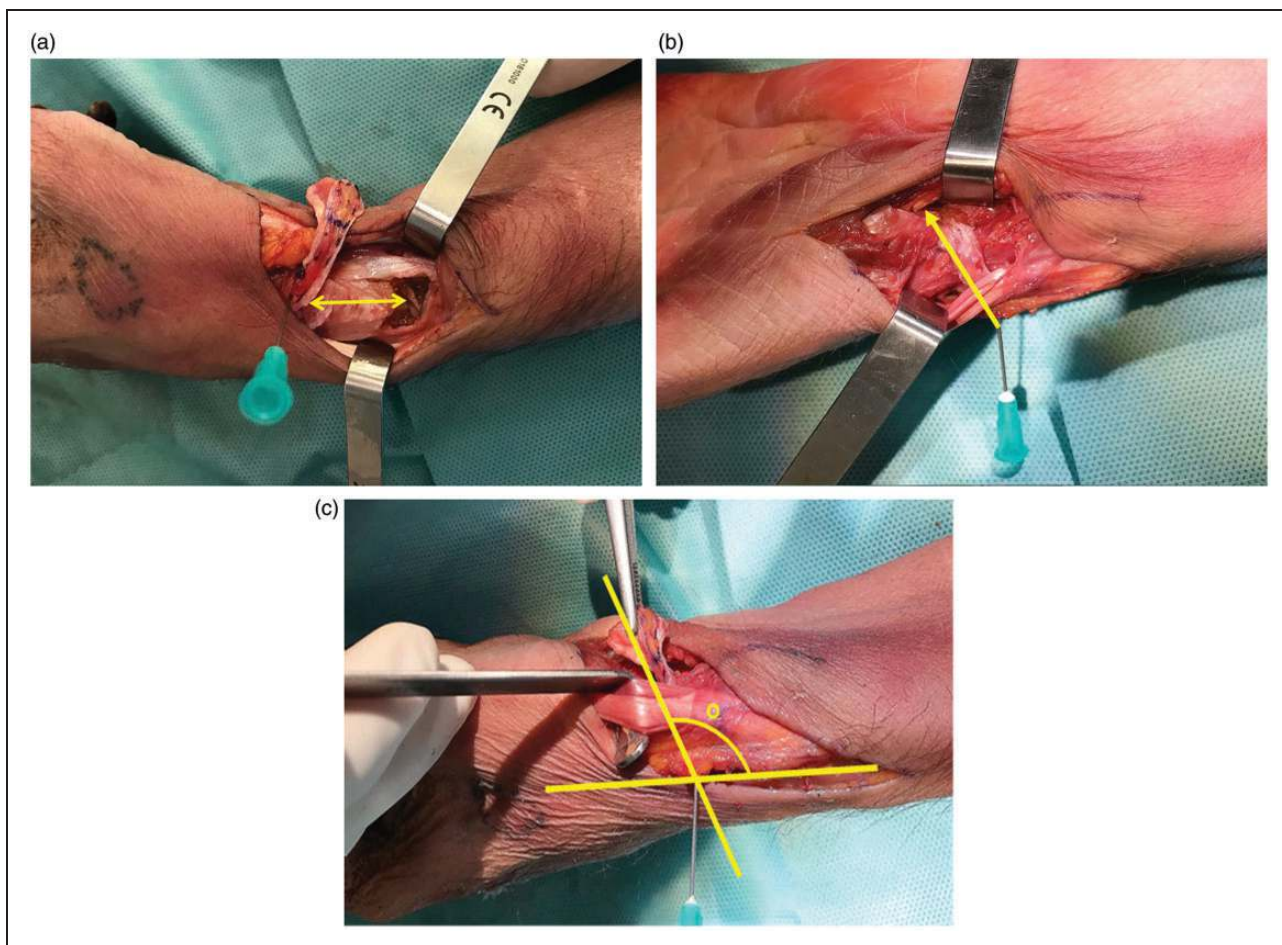


Figure 1. Anatomical measurements. (a) Distance between the harvest site and the radial styloid. (b) Distance between the radial styloid and the grafting site. (c) Measurement of the rotation arc of the pedicle around the radial styloid.

in the anterior site of the scaphoid with the wrist in a neutral position without tensioning the pedicle. The distance between the proximal edge of the graft and the tip of the radial styloid was greater than or equal to the distance between the tip of the radial styloid and the grafting site. These combined posterior and anterior approaches, rerouting the graft below the tendons of the first extensor compartments, offer good exposure of distal scaphoid non-unions. They enable the assessment and correction of any eventual scaphoid deformity and bone loss compared with the classic dorsal approach used by Zaidenberg et al. (1991).

In this anatomical study, we found volar graft of the scaphoid by the 1,2 ICSRA bone graft is possible, which may widen the indications of this vascularized bone graft. We have successfully treated 19 patients using this method.

Declaration of conflicting interests The authors declared no potential conflicts of interest with respect

to the research, authorship, and/or publication of this article.

Funding The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: this study was funded by Ramsay Générale de Santé – Capiro [grant number: COS-RGDS-2017-12-002-P-FALCONE-MO.

Ethical approval Institutional Review Board approval number: COS-RGDS-2017-12-002-P-FALCONE-MO.

References

- Henry M. Scaphoid nonunion: what is the role of the Zaidenberg 1,2 intercompartmental supraretinacular arterial flap? *J Hand Surg Eur.* 2018, 43: 41–7.
- Saint Cast Y, Césari B, Dagregorio G et al. Simplified scaphoid reconstruction technique with Zaidenberg's vascularized radial graft. *Orthop Traumatol: Surg Res.* 2012, 98: S66–S72.
- Waitayawinyu T, Robertson C, Chin SH, Schlenker JD, Pettrone S, Trumble TE. The detailed anatomy of the 1,2 intercompartmental supraretinacular artery for vascularized bone

grafting of scaphoid nonunions. *J Hand Surg Am.* 2008, 33: 168–74.

Zaidenberg C, Siebert JW, Angrigiani C. A new vascularized bone graft for scaphoid nonunion. *J Hand Surg Am.* 1991, 16: 474–8.

**Camilo Chaves^{1,2}, Ghada Asmar² and
Marc-Olivier Falcone^{2,3,*}**

¹University Paris Sud, Orsay, France

²Ramsay Générale de Santé – Capiro – Hôpital Privé

Paul d'Égine, Champigny-sur-Marne, France

³Clinique Internationale du Parc Monceau,
Paris, France

*Corresponding author: falcone.research@gmail.com

© The Author(s) 2019

Article reuse guidelines:

sagepub.com/journals-permissions

doi: 10.1177/1753193419876900 available online at <http://jhs.sagepub.com>